Master Design Reference Mission

Operational Context for Battle Force Engineering

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Engineering at the Force Level

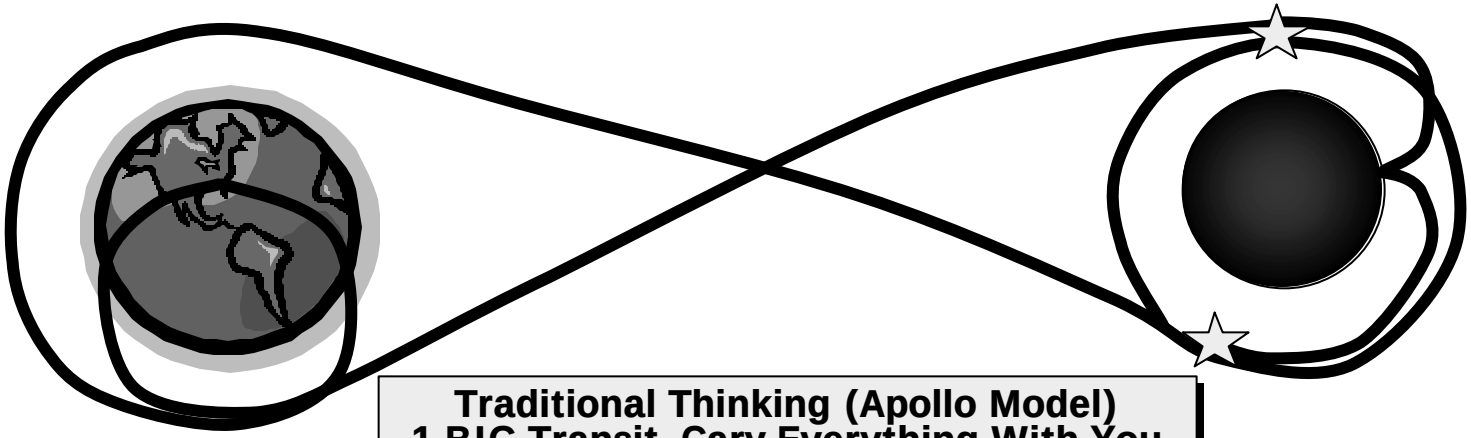
$$BF(PI) = \sum_{1}^{N} P_m(PI) + \int_{1}^{N} DS(M)\,dm(PI)$$

Battle Force Capability = **Sum of Platform Capabilities** + **Integration of Distributed Systems Across the Force**

BF - Naval Battle Force (Carrier Battle Group(s) and Amphibious Ready Group(s)
Pm - Platforms (ships, aircraft, submarines, land vehicles)

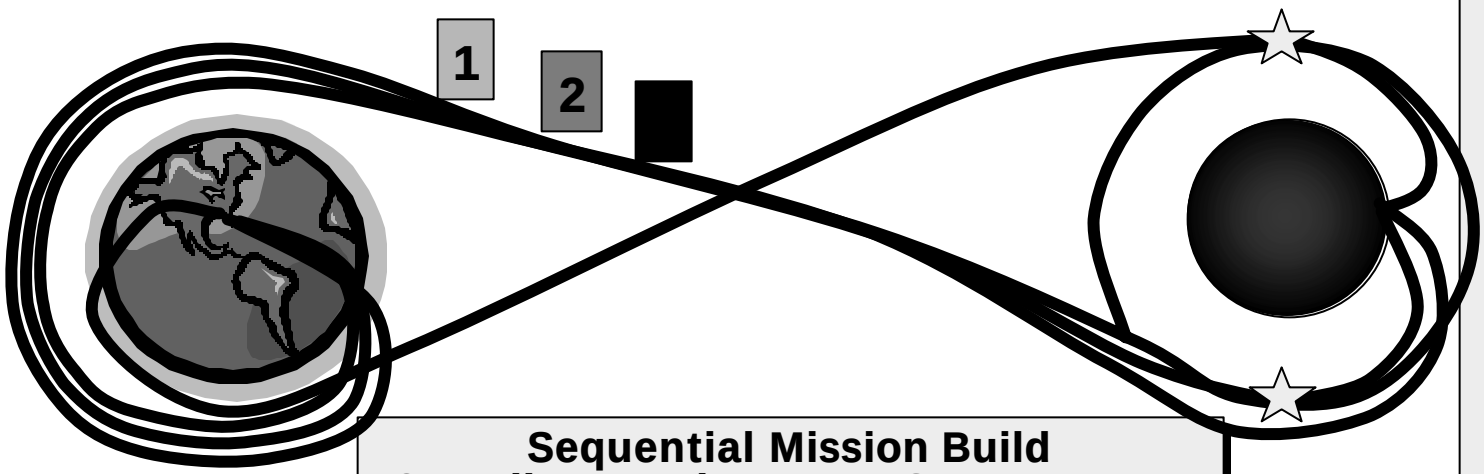
DS - Distributed Systems across force units that together provide force capability
(PI) - Defined Performance Package with Prescribed Interface (an architectural object)

Two DRMs For A Mission to Mars



Traditional Thinking (Apollo Model)
1 BIG Transit, Cary Everything With You

1. Earth Launch, Transit Mars Establish Orbit Module
2. Separation & Mars Descent
3. Mars Ascent & rendezvous
4. Transit Earth

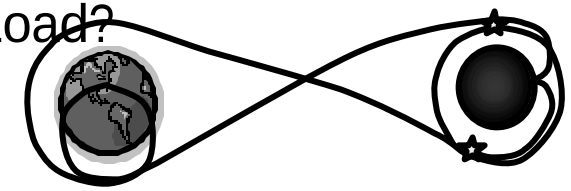


Sequential Mission Build
3 Medium Rockets, Pre-Stage Return

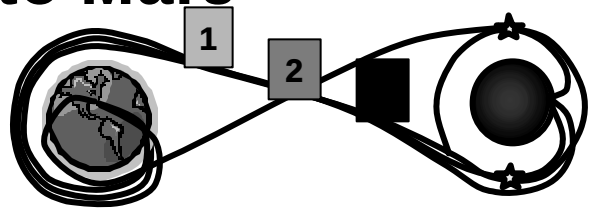
1. Unmanned Earth Launch, Transit Mars Establish Orbit (return module, habitability module)
2. Unmanned Earth Launch, Transit Mars, Descent Mars (Mars ascent module staged)
3. Manned Earth Launch, Transit Mars, rendezvous
4. Separation and Mars Descent
5. Mars Ascent & rendezvous
6. Transit Earth

Questions to Ponder

- **"Apollo 21" Manned Reference Mission to Mars**
  - How big is BIG? Propulsion? Fuel & Stores Load?
  - Redundancy? Simplicity?
  - Contingency plan (exit strategy, lifeboat)



- **Staged Manned Reference Mission to Mars**
  - Propulsion? Timing of Launches?
  - Redundancy? Complexity
  - Contingency plan (exit strategy, lifeboat)



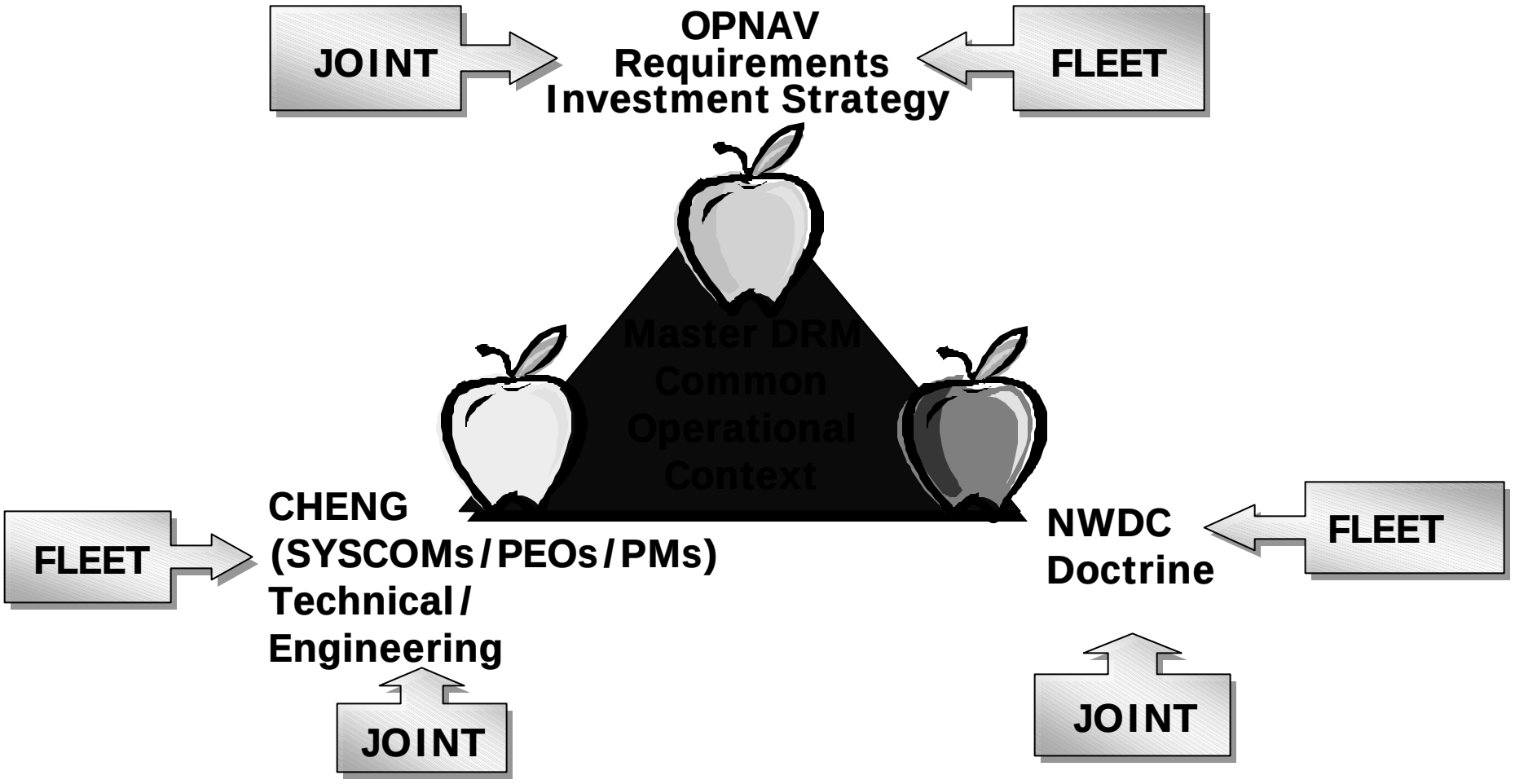
- **Questions**
  - Do both achieve mission? Which is more cost effective? Cheaper?
  - Which requires more engineering?
  - Which requires more technology?
  - Which could be fielded sooner?
  - Which is "safer"?
  - Which factors of the reference mission drive your answers?

Master DRM Objectives

- **Support the Battle Force System Engineering process**
  - **Operational Context**
    - **Capture Design Stressing Operational Factors**
    - **Embody Mission Success Oriented MOEs to Guide Design Trades**
    - **Includes "CONOPS"**
  - **Responsive to Technical Analysis and Testing**
- **Support assessment of prospective Navy investments**
  - **Operational Context**
  - **Responsive to Campaign and Force Analysis**
- **Provide a common framework for all other DRMs**
  - **Consistency among DRMs**

Establish Operational Context and a Common Analytic Environment

The Master DRM Facilitates More Meaningful Analysis



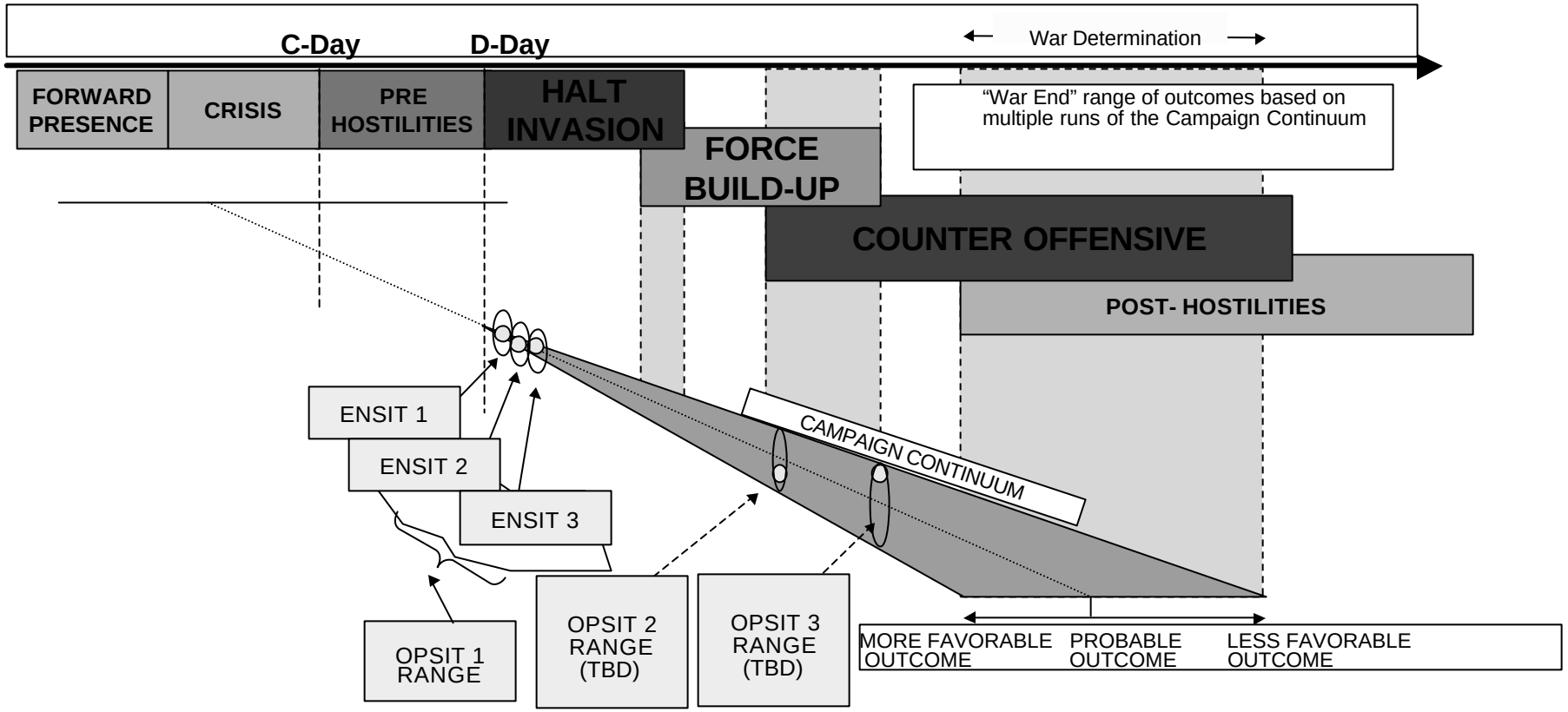
DRM Operational Context

- **Set within the framework of a Joint Campaign.**
- **Scenario is developed to ensure that stressing (and realistic) cases are depicted.**
- **Contains the breadth of physical environments, threat geometries and geographies**
- **Provides a diversity of conditions that could be encountered by a system of systems**

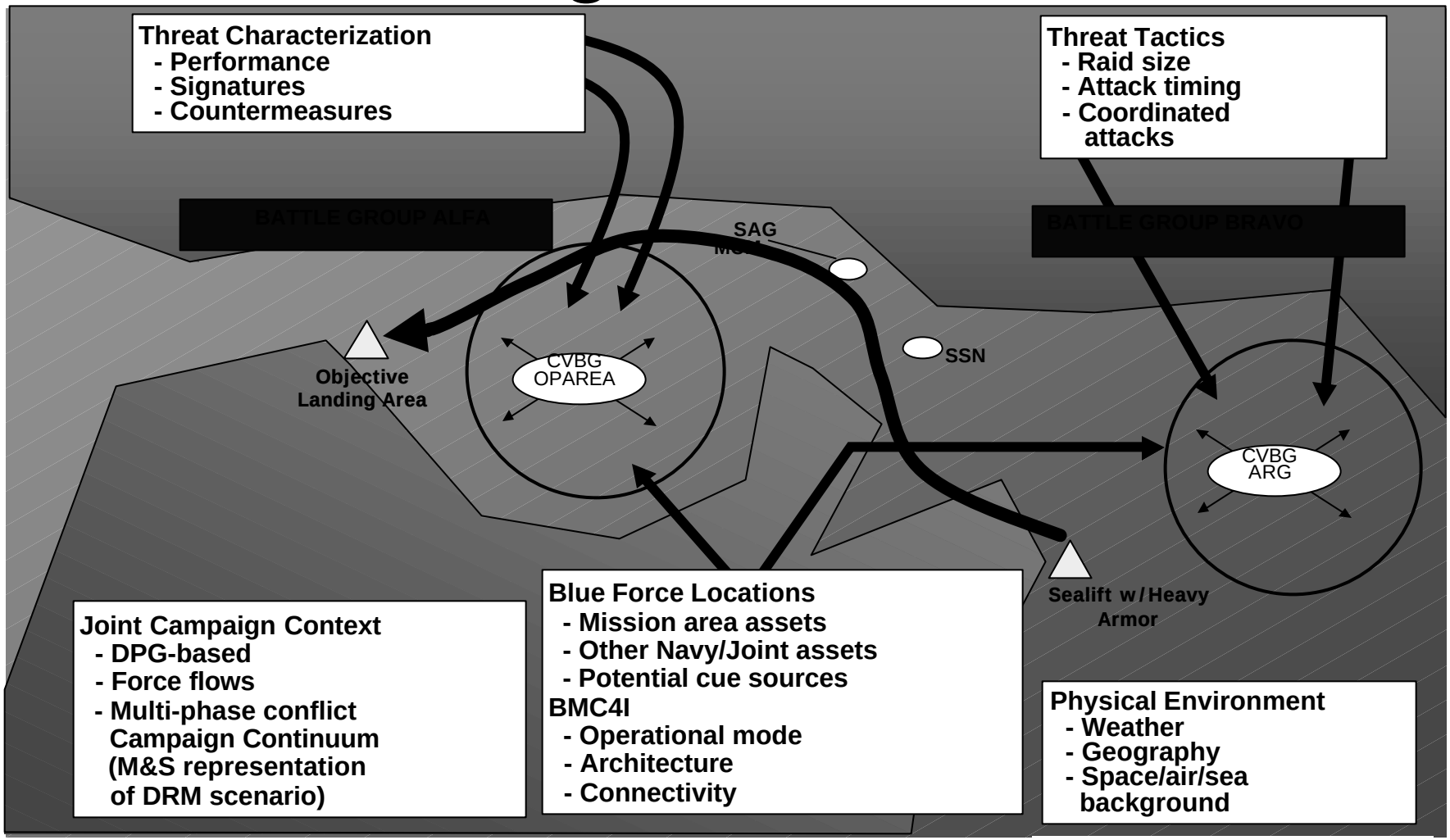
SEVERAL DPG SCENARIOS MAY BE NEEDED TO YIELD THE DESIRED VARIETY OF THREAT AND ENVIRONMENTAL CONDITIONS.

The Campaign Continuum

- **Provides Dynamic Campaign Modeling of a DPG Scenario**
- **Provides a Continuous Multi-warfare Flow of Situations Throughout the Campaign**
- **Develops the Range of Critical Initial Conditions for Systems Engineering Analysis**

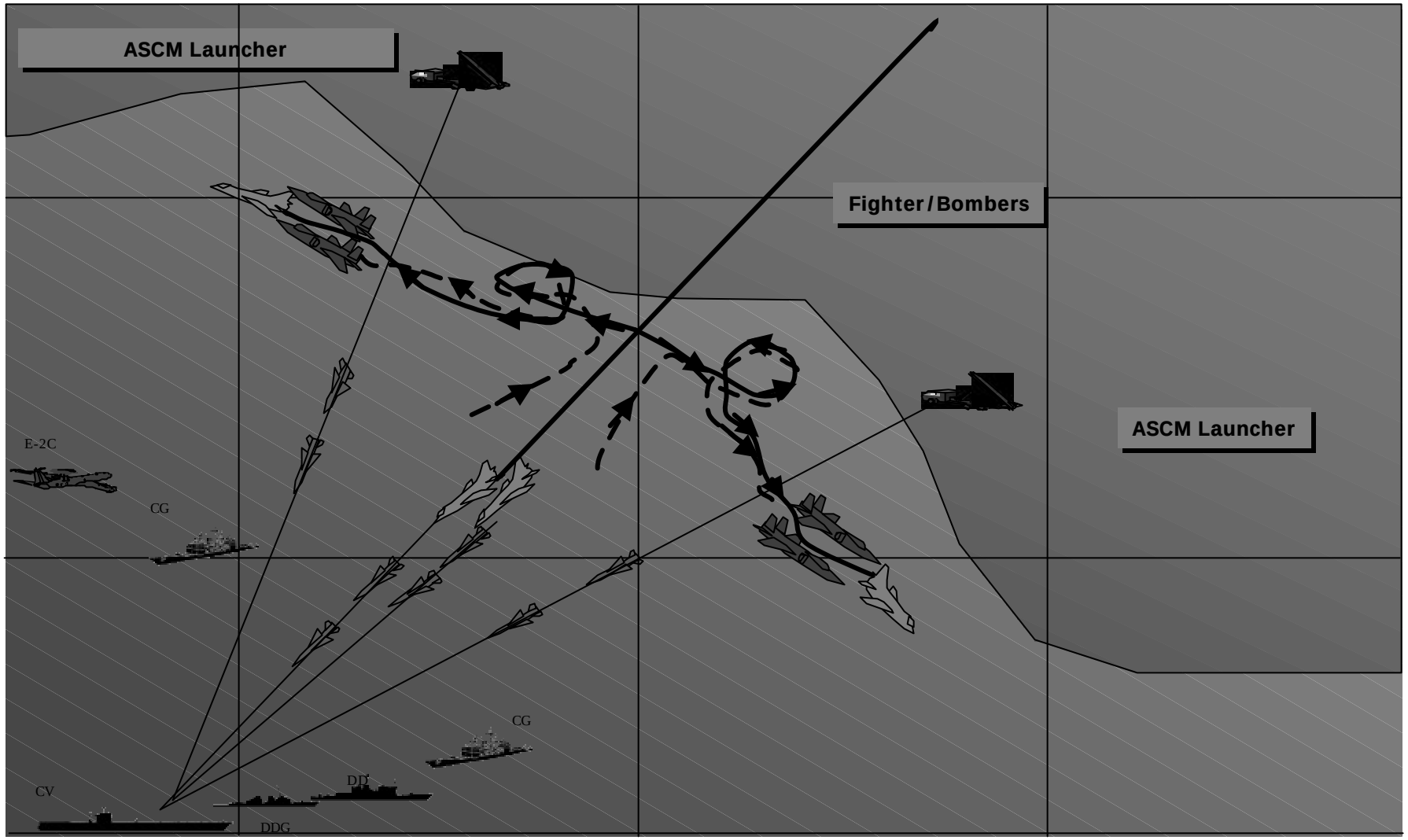


Battle Force Design Reference Mission



Establish Operational Context And A Common Analytical Environment

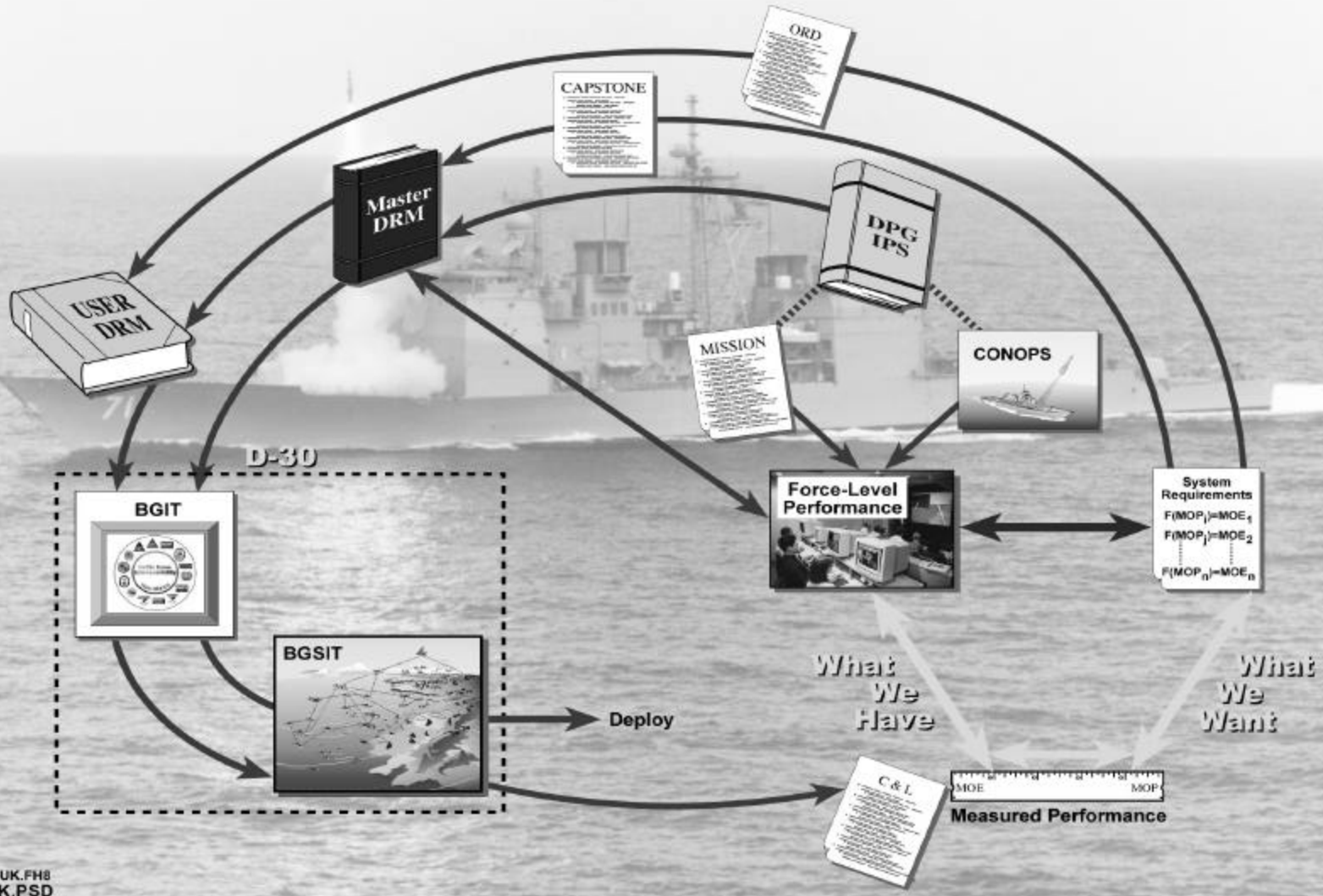
ENSIT Example



DRM Environmental Annex

	NEA-1	NEA-3	NEA-5	NEA-7	NEA-9	NEA-11	NEA-13	NEA-16
Month	Jan	Mar	May	Jun	Aug	Sep	Nov	Dec
Lat. (°N)	39	38	37	35	34	35	37	39
Long. (°E)	124	124	126	126	127	129	129	128
Wave Height (ft)	2.7	1.8	1.7	2	3.3	1.9	4.4	3.7
Primary Wind Dir.	N	NW	W	NW		NE	NW	W
Wind Speed	11	11	8			9	14	14
Sea Surf Temp (°F)	34	37				72	55	43
Air Temp. (°F)	25	37				71	49	34
Dew Point Temp. (°F)	11	29	5		73	63	38	22
% Rel. Hum.	57	73	86	89	84	74	65	60
% Freq of Gales	x	0	x	0	x	1	1	1
% Freq of Light Icing	x	0	x	0	x	0	0	12
% Freq of Heavy Icing	x	0	x	0	x	0	0	0

Master Design Reference Mission Process



Ongoing DRM Efforts

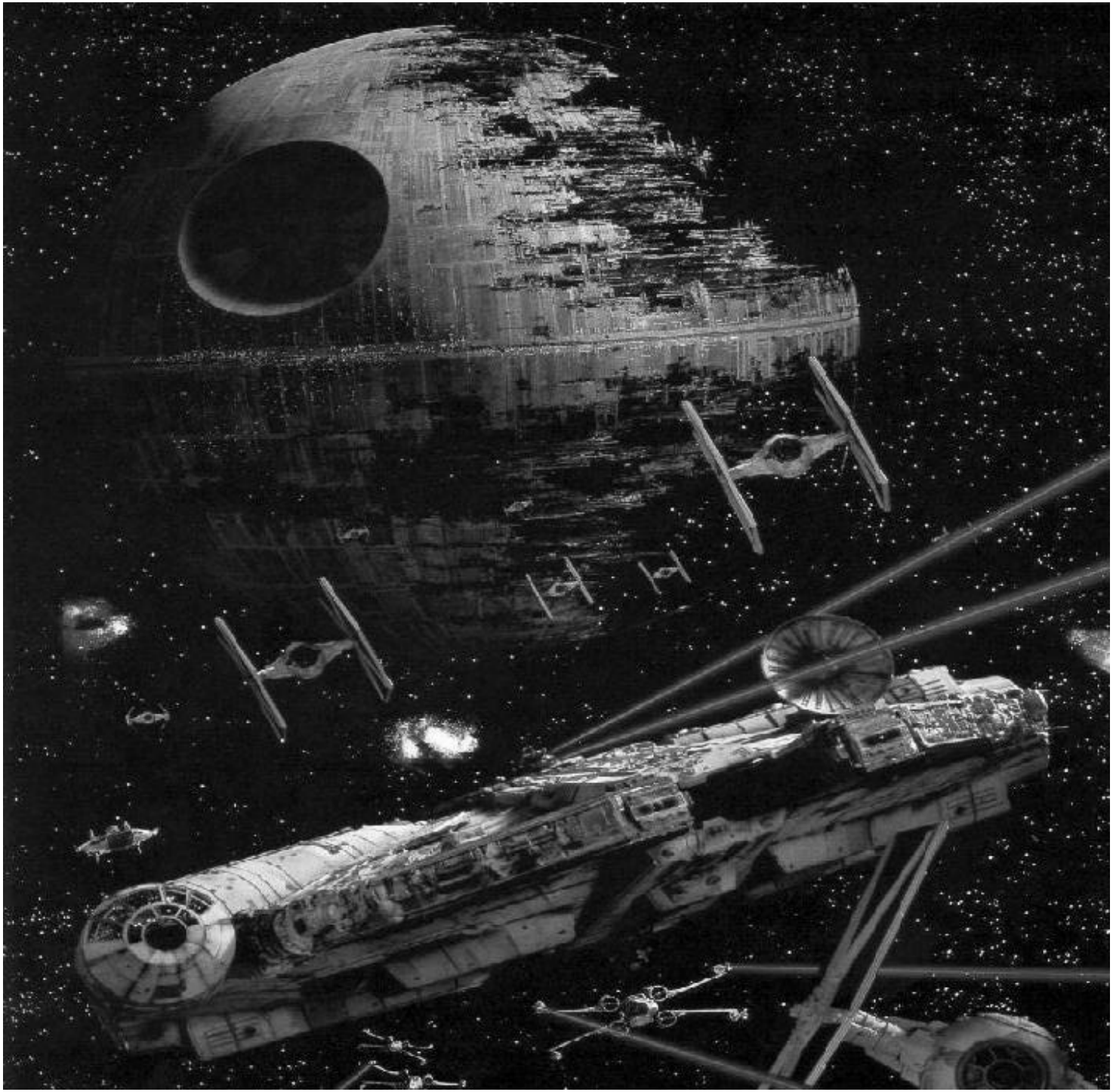
- Naval Battle Force *(SEA 53)*
  - SW Asia 2005, NE Asia 2017
- Warfare Areas
  - TAMD *(PEO TSC)*
    - AAW, Area, NTW, OLCM, AADC
  - ASW *(RDA CHENG/N74)*

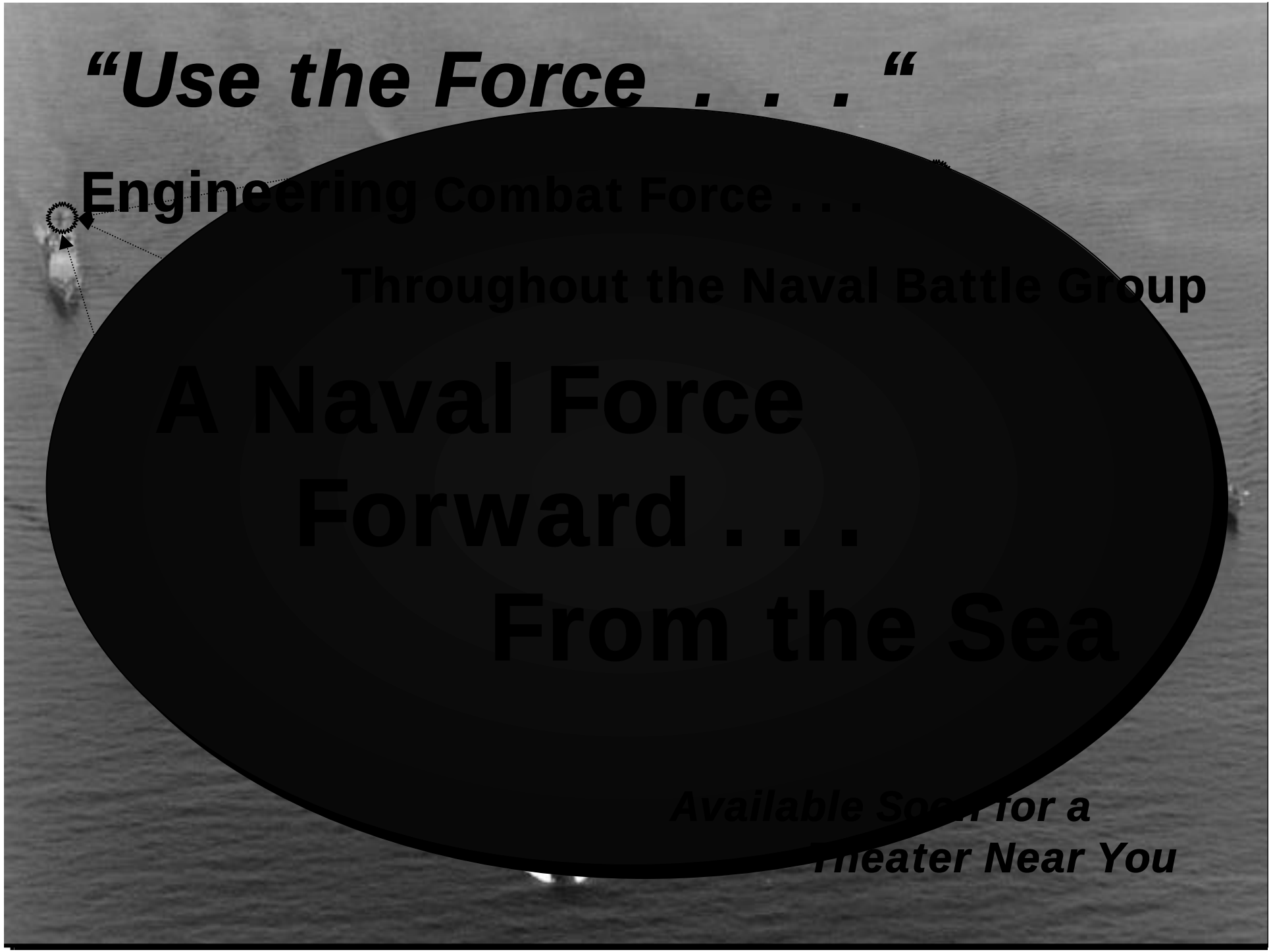
- Joint Force *(SIAP)*
  - SW Asia, NE Asia, AGCS

Master DRM Summary

- **MDRM is an engineering/design tool**
- **Defines the problem, not the solution**
- **Official threat/physical environment characterizations and OPSIT families**
- **Operationally viable...Real threats, geography**
- **Common Operational Context for trade off analyses**

Master Design Reference Mission
A Force Warfare Systems Engineering Tool




"Use the Force . . . "
Engineering Combat Force . . .
Throughout the Naval Battle Group
A Naval Force
Forward . . .
From the Sea
Available Soon for a
Theater Near You


NAVSEA
NAVAL SEA SYSTEMS COMMAND
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Mine & Undersea Warfare
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